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Greenhouse Gas Abatement with Distributed Generation in California's Commercial Buildings

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http://eetd.lbl.gov/EA/EMP/emp-pubs.html

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Greenhouse Gas Abatement with Distributed Generation in California's Commercial Buildings

Keywords: carbon emissions, climate change, combined heat and power, commercial buildings, distributed generation, microgrids

Project started: January 2009
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Project partner: University of California, Berkeley

Motivation & Objective for this Research

to determine the role of distributed generation (DG) in greenhouse gas reductions by

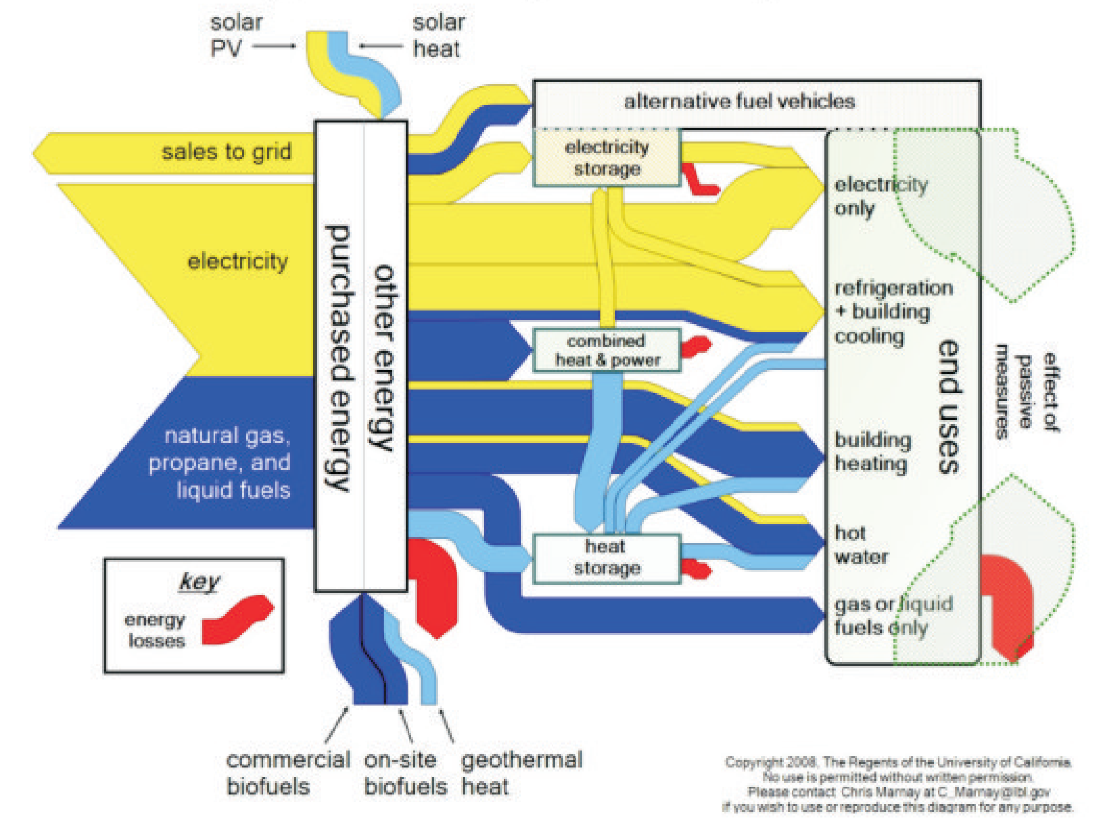
- **applying the Distributed Energy Resources Customer Adoption Model (DER-CAM)**
- **using the California Commercial End-Use Survey (CEUS) database for commercial buildings**
- **selecting buildings with electric peak loads between 100 kW and 5 MW**
- **considering fuel cells, micro-turbines, internal combustion engines, gas turbines with waste heat utilization, solar thermal, and PV**
- **testing of different policy instruments, e.g. feed-in tariff or investment subsidies**

Distributed Energy Resources Customer Adoption Model (DER-CAM)

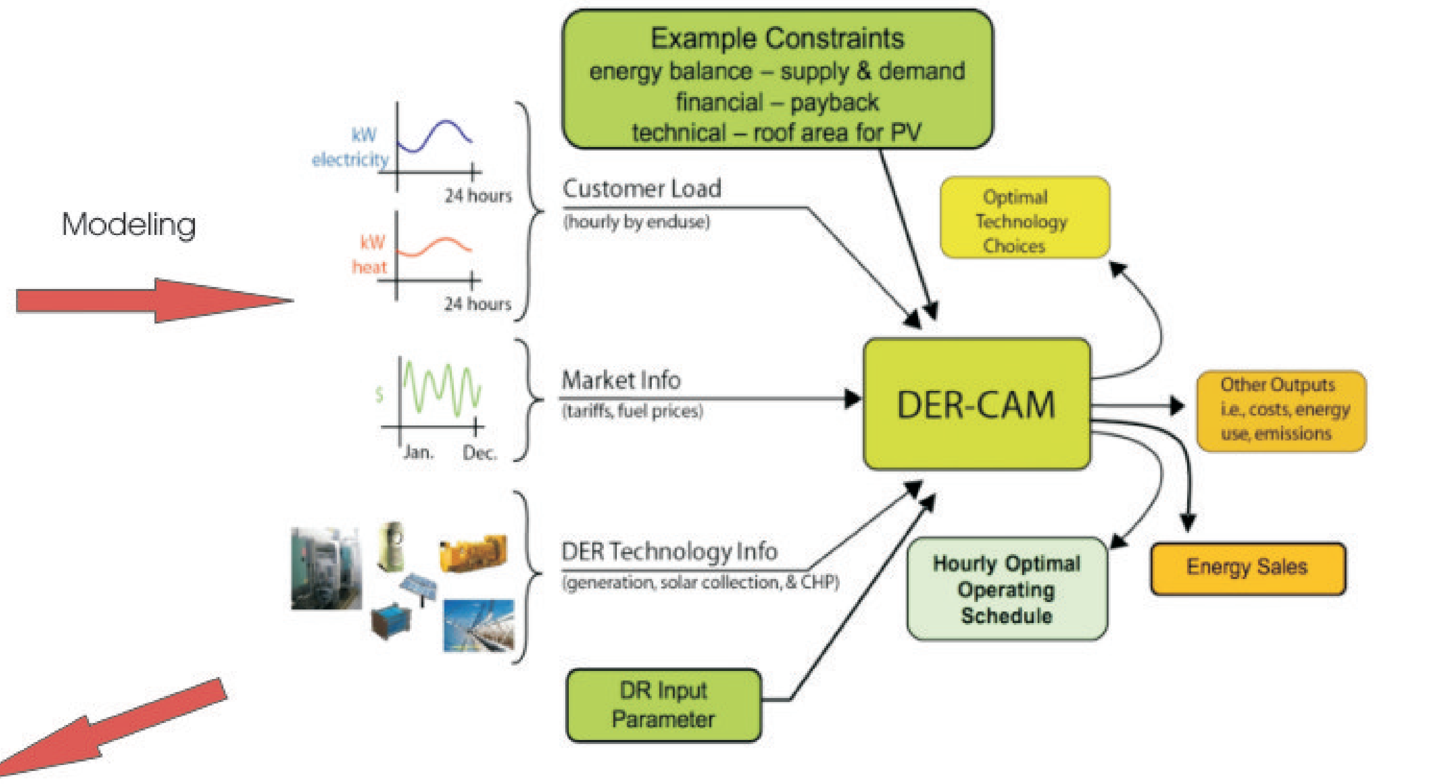
DER-CAM optimization techniques find both the combination of equipment and its operation over a typical year that minimizes the site's total energy bill, including amortized capital costs, or CO_2 emissions by considering

- hourly load profiles for electric, heating, cooling, and natural gas loads
- any onsite technology that can be described by capital costs, O&M costs, efficiency, etc.
- building / microgrid energy balance
- operating constraints, e.g. solar radiation
- regulatory constraints, e.g. CO_2 prices / taxes or zero-net energy buildings

Schematic of the Energy Flow in a Building - Global Concept



High Level Schematic of DER-CAM



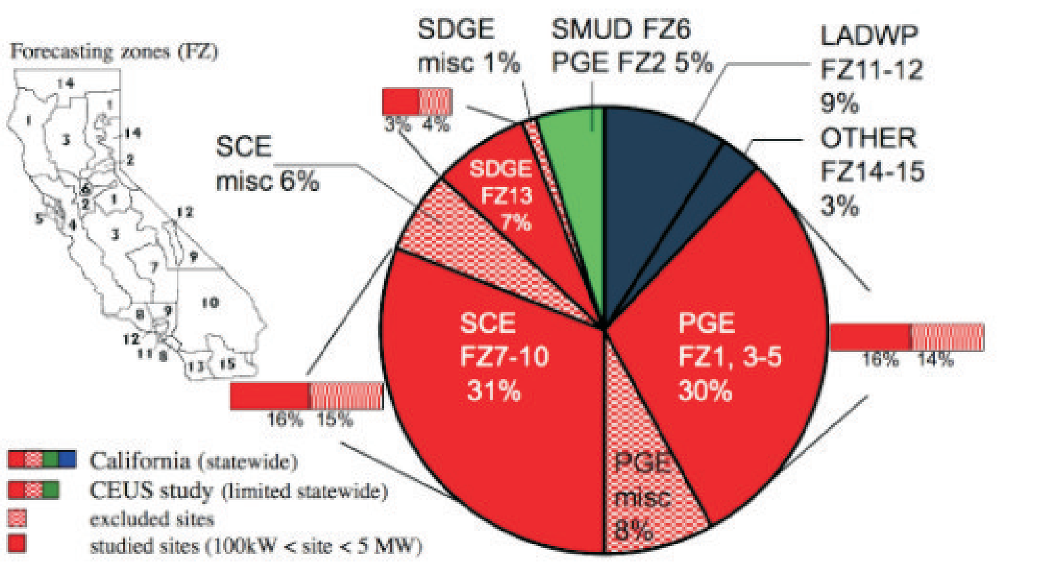
California Commercial End-Use Survey (CEUS) database

CEUS database contains 2790 premises from PG&E, SMUD, SCE, and SDG&E service territories:

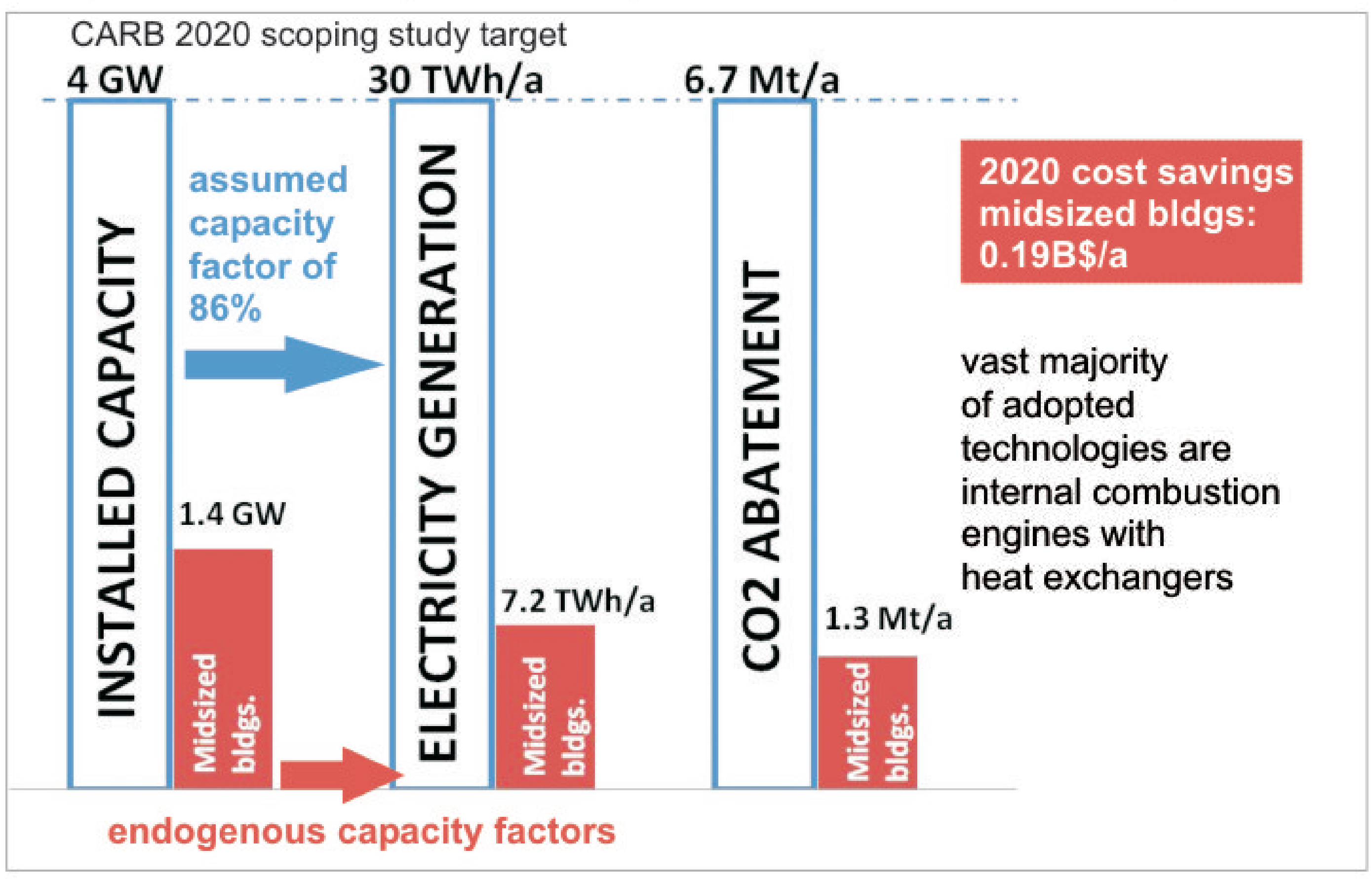
- 12 building types, e.g. schools, colleges, hotels, warehouses, etc.
- 12 forecasting Climate Zones (FZ); using 10 year normalized weather sample; containing simulated hourly estimates of end-use electricity and natural gas consumption
- eQUEST simulations (frontend tool for DOE2)

35% of commercial electric demand considered

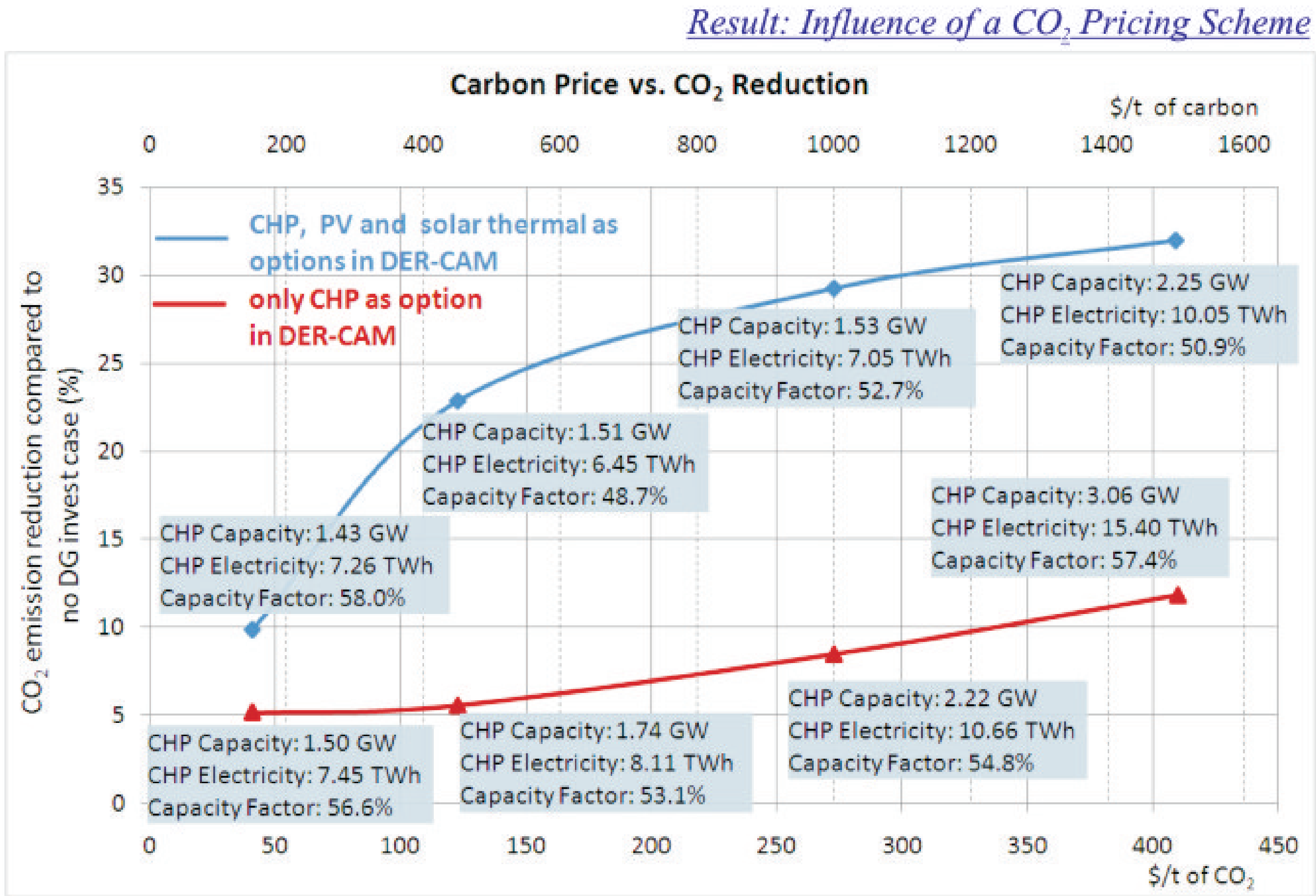
- buildings between 100 kW and 5 MW electric peak load are considered
- no miscellaneous building types
- SMUD and LADWP are not considered



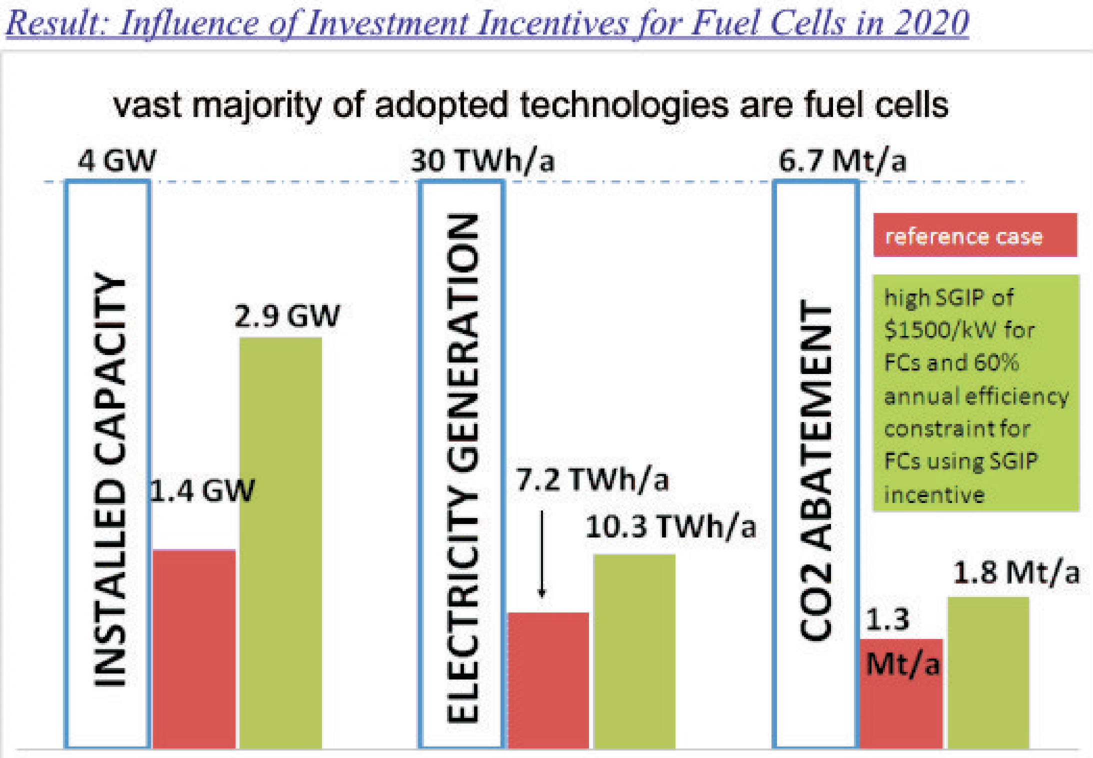
Result: Reference Case in Comparison to California Air Resources Board's (CARB) 2020 Goal



Result: Influence of a CO_2 Pricing Scheme



Result: Influence of Investment Incentives for Fuel Cells in 2020



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